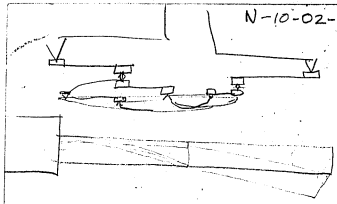
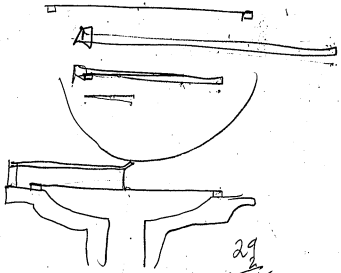
Notebook, N-10-02-11

This notebook covers the period February-April 1910. All entries are by Edison. It is the first of three books that contain notes and drawings regarding the development of phonograph recording and reproducing apparatus. A notation in the second book indicates that much of this work was conducted at Edison's laboratory at Fort Myers, Florida. In an entry dated April 9, 1910, Edison notes that "the talking is the clearest & best I have ever heard on the phonograph Bar none" and that "this is the Recorder par excellanc to work with—." Several entries indicate the involvement of Alexander N. Pierman and Frederick P. Ott. At the end of the book are cost calculations for storage batteries and for cement production. The front cover is marked "Phonograph No 1 Feb. Mch. April. 1910." The pages are unnumbered. Approximately 160 pages have been used.

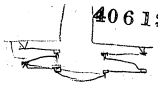
N-10-02-11

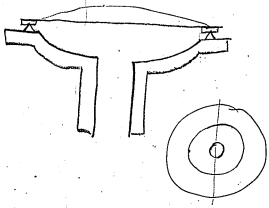




Rome Co.,
MFG. STATIONERS,
69 FULTON STREET,
NEW YORK.

40618





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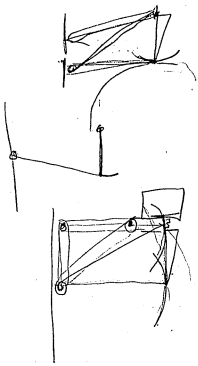
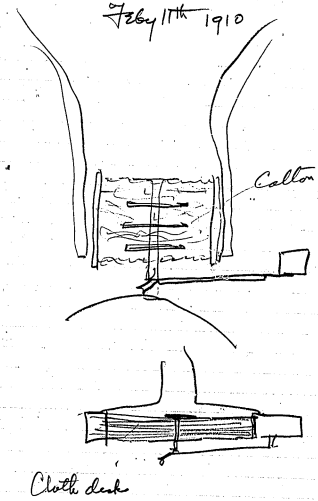
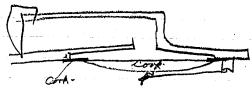
54

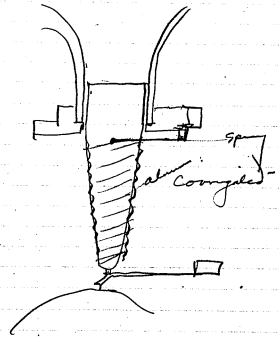


Feby 17th 1910

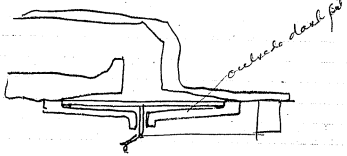


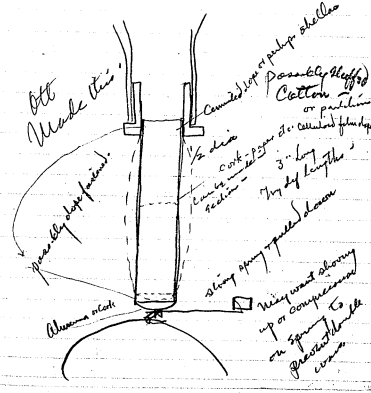
February 11 1910





February 11 1910





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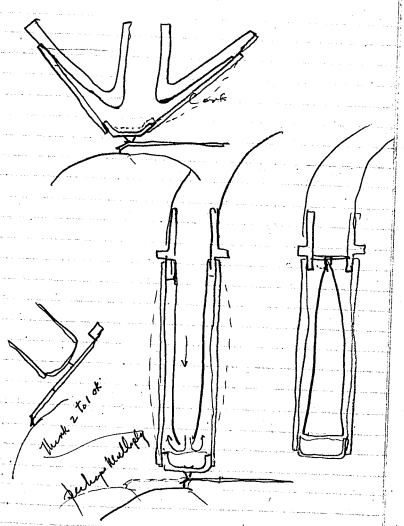
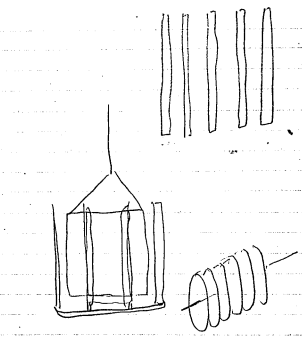




February 11 1910

Tube diaphram

165
62
330
9900
102 8

102
30
72

62 | 72 (1.16
62
120
120
58

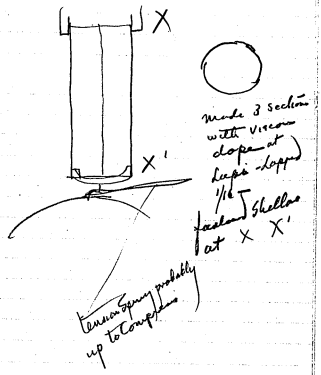
8500
10200
12480
304
5

120 lbs

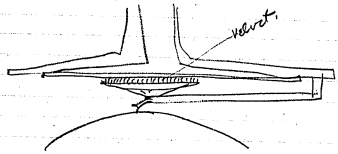
446
120
892
446
53520 | 244
244
1000 | 21480
20000
1480
1400
80
80
14

62
220
124

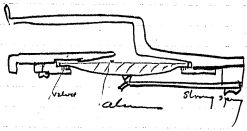
Feby 11 1910

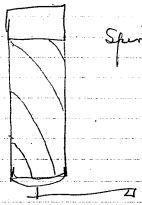

X
X'
Made 3 sections with visceum slopes at lapis slopes 1/16
Fasten Shellac at X X'
Tension Spring probably up to complete

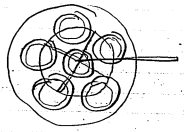
Feby 11 1910

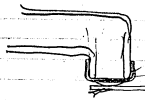


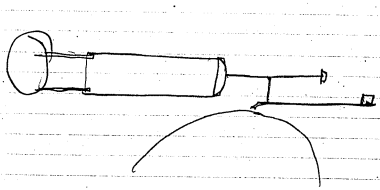
Feby 11 1910

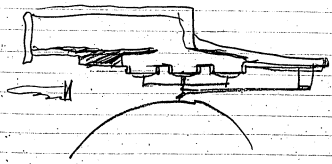


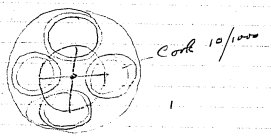


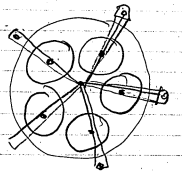


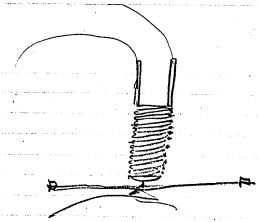


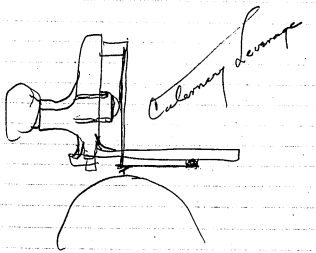


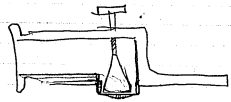



Cork 10/100

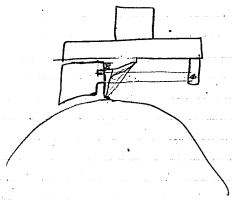


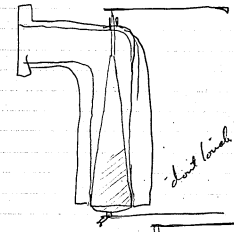


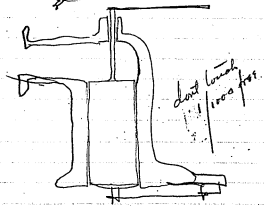

Calomey Lemmy



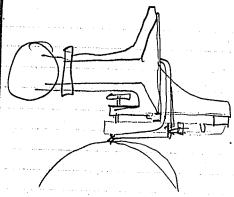
Try one of good recorders
& work the rubber connector
on funnel & stand with
end to end so rubber cant
vibrate or leave an enlarged
cavity
as stud cup is fixed make a
fit on a taper -



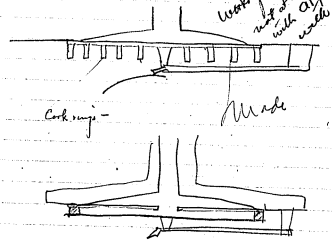

dust brush

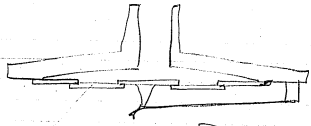

dust brush
1000 fps

Feby 19 1910

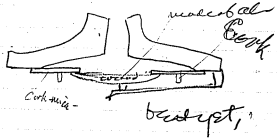


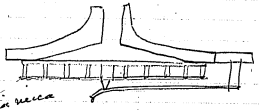
Works good with Cork
not at all ⊕ in conjunction
with Alfalfa
with Line





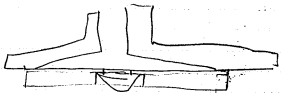
Cork-Rings - drop around Edges -

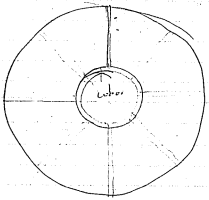




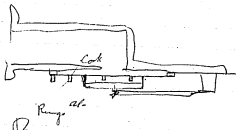
2 dia wooden
Cork rings in
between

must be 1/32 notch here to insure
right diameter of <u>piece</u> dropping + not
irregular dope edge as now -

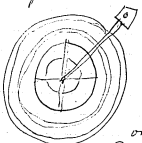




Feby 26 1910


Cock

Best yet,

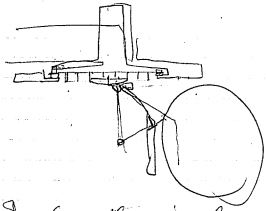


loud + no doubles on low or high, or saw specks.

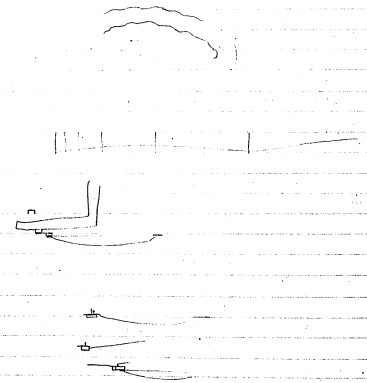
small fair. Base rattles low

Reproducer must be improved as some heads work far better than others, some seem quite flutters & doubles others OK

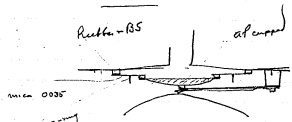
Showing lot trouble in Replay



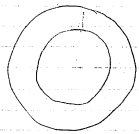
Spacers with rings – of
Celluloid – also cork
~~[illegible]~~ Celluloid disk also mica.
003 + cork rings – al. rings for
knife heads



Feby 27 1910

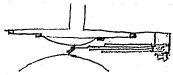


Dowels to wall
Ring dimples
amplitude



Schemes for limiting large vibrations without damaging adjustment of small vibration

No 1



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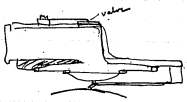

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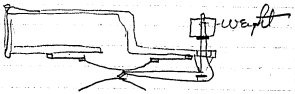

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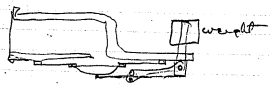

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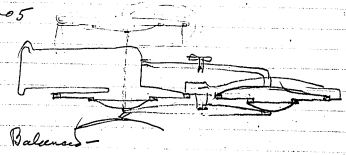

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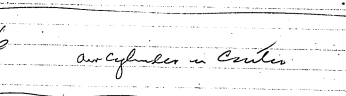

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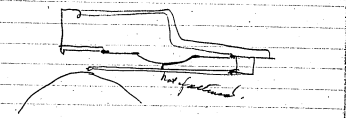

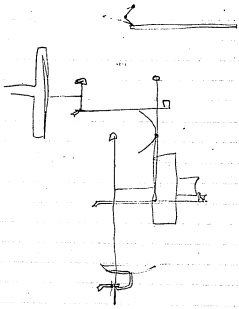

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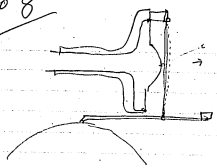
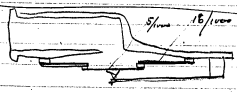
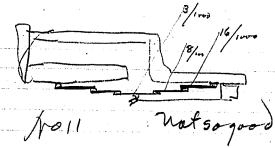


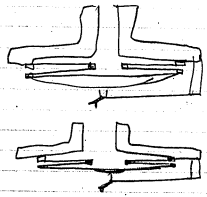
No 9

Mica Disc



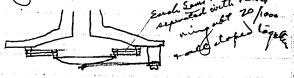
No 10


3/inch
16/inch
18/inch
Nail
Notsogood



March 8 1910

Best so far —



3 mm dia 5/000 thick sink total
15/000 + yet to loud — most of our
dies — Piano is loud + yet drowns out
show any sign of jump out —
Pianoman high note loud enough
do not jump out although it
hopped very much over each other
This Recorder is the most sensitive
Compound to the tenor the gave
loud record without jumping
that we have now loud —
Quality good —

The first Experiment we
used 3 3/000 dia it was
very loud for piano but
had false sounds due to
buckling + reaction of
our diaphragm on the Ebb
other yet on Pianoman

loud high note deduct
jump — it was high water
mark in this respect
Could we succeed in
using the 3 3/1000 we
would have nearly all
that is desired — possibly
we can stop cavities
by filling in the 20/1000
space between ring diaphr.
by Cotton or other material

One peculiarity in Ch
dia is that with 003
ring dia. The Talking is
not sharp but clear
but on other hand the
Piano is rich especially
the bass which is perfect
rich & loud high notes
not sharp enough —
We believe Records for Piano
Xylophone etc where sound
is sudden should have
this property wherever

in talking or vocal
it should be very much
sharper + 2 kinds of
recorders will be necessary

against the use of 3 .005 dia
would make them heavy
but by use of the .006
aluminum central disc
not flexing we lighten
very much - this can be
carried further + possibly
.003 wire can be used
by keeping whole disc
of diaphragm same but make
the center at from 7/8"
to 1 inch dia - this would
~~that~~ not lighten in case
of .003 but would in case
of .005 - but the .003
would probably get
nearly if not free of
buckles —

The problem is to use .003
+ get free from buckles +

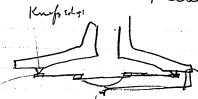
sharpen high notes which may be possible with Collar or by thinning inward the Knife spring —

I tried the Tri diaphm device with the 3 semi diaphs separated by papers made of rubber + stiff dope but the sound was lower than if a 12/1000 dia was used. — very sharp. It shows that the Tri Dia should act like a multiple leaf spring ie the edge of the inner under be free to move — also the 3 semi diaphs did not swing from the same Center + thus caused inner binding —

I am now trying a single ring dia 10/1000 but with outer edge resting on a Knife edge

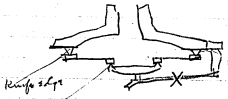
Then

March 8 1910 Best up to date



Rubber ring cemented to ring dia of Mica

This should make diaphram more sensitive if this works will do same, leaving on non flexing dia thus



No 2

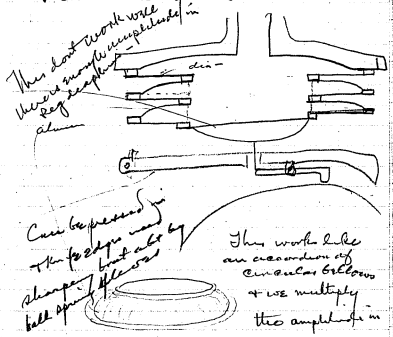
Bowing X inward to seal air tight =

This should be good for Repairs

This is fine just bored to pressure inward to diaphram light no leak Round fine no flaws - 10/Dec Dia family bowl inward & broken more colorate, see Pg 7 No 2

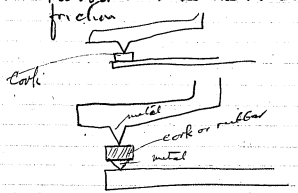
March 8 1910 — page BX

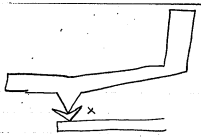
What appears to be necessary in a Reproducer to allow increased leverage & louder sounds to be reproduced is to diminish restriction of amplitude of the diaphragm I am making this.



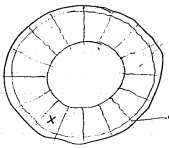
It is probably much better to sharpen the sound of the record by a stronger knife spring bowed in from to obtain the same result by thickening the diaphram between in holes. Case you add to weight or diminish amplitude — whereas with the knife the same sharpening is obtained without any limitation to amplitude —

Think that possibly Cork might be better than Rubber as less internal friction





possibly no cork or rubber at
all x being metal —
Oh no No — one on me —



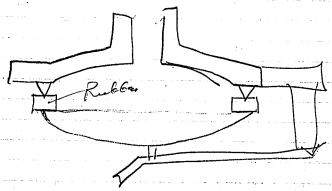
X Mica Sections cemented by shellac on
metallic ring - .003

Sections do not quite butt - filled in slots
with Cardolite or rubber cement
.003 slot, total leak 40/second

Mch 8 1910

This gives due of great amplitude & sharpness attained by outside knife opening or Extra Spring to balance wt of Sprinkler —

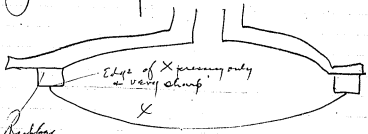
Possibly a non flexing design could be used also



By forming in the knife opening could get required amplitude with Rubber duplicating at knife & Early Pay

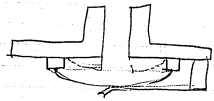
March 8 1910

Possibly this



probably much deeper
would be better as much lighter
& less work to do on rubber
Even cork might work if edge
sharp enough

Chamber might be this



March 8 1910

I now know that the reason we never could amplify the sound to any great extent by leverage no matter how hard the record is because the range of playing in the D. machine has been ridiculously too small — no ordinary design will permit it — plate 13X shows an arrangement which makes amplification by leverage possible.

One of the hardest problems yet to be solved is to get the repeating ball to track in the middle of the record, on strong records ~~that~~ where one groove cuts into the other there is also ~~[illegible]~~ pounding produced by ball always travelling on the side not always but generally

March 8 1910

One solution is to use a brush of hog bristles connected to the weight the bristles running in normal grooves of recipro shoned track the ~~[illegible]~~ weight always hung at central then the Spdaker ball would be central in case of 200 thread 50 threads would be covered by the bristles - probably a Chamois skin pad could be used instead

In fact the weight could be semi floating + doubled in weight 1/2 of the weight taken on the chamois + the other by the ball which would be same wt as now but the extra wt taken by the chamois or bristles would tend to stop rattling + do same thing as doubling the wt without having it all on the ball +

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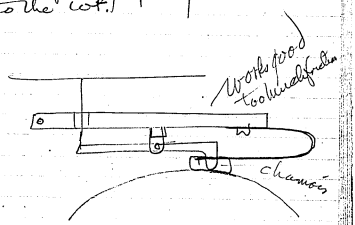
on the chamois could be put on a flexing spring (mounted to the lot.)



Possibly Rubber could be used but that friction too much —

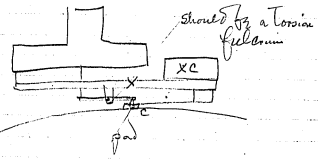
to track possibly must be an adjustment to track right by eye then it should not require any further adjustment

flexing of ¼" on chamois spring would be enough

16-3
143
2
63
181
12000
108
16

Mch 9 1910

Good –



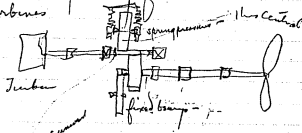
balance weight of lever X 6 oz
Spring + pad resting on second
so no weight pressure on rupder
point rear and add $1\frac{1}{2}$ oz to XC
this will give $1\frac{1}{2}$ oz pressure
on rupder ball but when
recoil return takes place we
have of X was originally
$1\frac{1}{2}$ oz we have for inertia
3 oz instead of $1\frac{1}{2}$ yet
there is only $1\frac{1}{2}$ pressure on ball
this represents weight jumping
on load recoiling –
This can be carried still
further – + some time it

Mch 9 1910

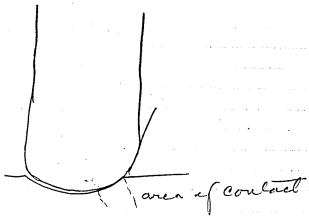
the pad feeds the lever right a
stop side pressure of ball
which can be adjusted
central in the track

If the later is not required
a wheel could be used for
even on a weakly geared
phono a pound of weight,
could be used for inertia
wheel? ?

Reduction gearing for Steamboat
Turbines



Too much power [illegible]



1

12/16 — 1.15 10
6/16 3/4 5 =

24
2

March 9 1910

X is the polished truck of Reproducer ball on Loud records on Reg white Record wax 2½ oz weight — I cannot quite see why this always acts sideways Especially when Record is Dupled on an Equal duplicating machine to Recorder

March 9 1910

We are just tried the double
Knife edge & this the best yet
Every vibration perfect & louder
than with single knife edge
on the outer edges — overtones
better & also bass 10/1000 dec

Knife spring bowed in just
Enough to seal chamber
by forcing knife edge into
rubber —

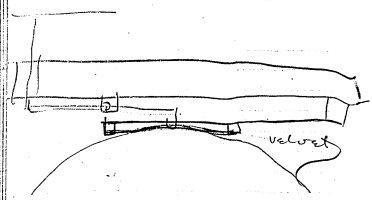
No jump out on Piano
hard scale & piano record
hardly noticeable Not with
a whole of jump out
showing that the more
perfect you get the nearer
Microphone the less
Compression to the Eye is
the record indeed & at same
time the record really gets
louder this proves
apparently that these
big indexes are false &
due to buckles etc

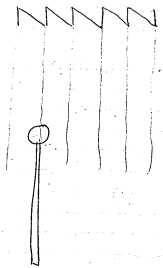
March 9 1910

This experiment shows that Gossing in is a good trick as the way vibrates in one direction & increases in power required to flex vibrates in the other direction & thus demonstrates tendency for knife to leave the way

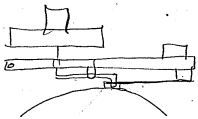
just tried 6½/1000 Mica diaper with double knife shape the louder but has few false waves – not preferable to 10/1000 No jump out on piccolo & loud notes & piano works small –

We are going to try Experiment of Double knife edges & Mica without Rubber using Castor oil to make a film to stop microscopic leakage





Mch 9 1910 -

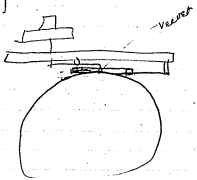


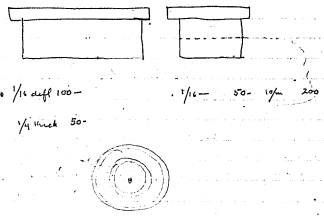
pad -

Def. input instead of pad use a wheel of disks - 20 of them loose on shaft so each can run in grooves

use comb of 5 spring prongs each with sapphire ball on

Velvet pad -



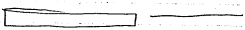


Mch 9 1910

It is possible that if 1/4" deep groove was used one 1st point of record + the weight was unwinded for Guide movement Except from a friction that the ball running on the deep track would overcome the friction & start right for whole record providing the Exp and on & Contraction of record was OK –

It is very desirable to make the diaphragm as light as possible to get quickness or sensitiveness & at same time sensitiveness WE now have 1.5" diam diaphragm 10/1000 thick which is ok ~~[illegible]~~ Weight say 100 % Resistance 100 %. If we 1/2 the diameter, using 10/1000 we reduce cost to 25 % – + have Resistance 100 % as here is 1/2 length. 1/2 as many of them ~~[illegible]~~ which equals, but area is 4 times less, hence must flex 4 times as much + thus takes twice power

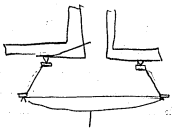
2" dia -
½ D 4 times less wave leverage
if ½ the length of lever. 4 times power get same amplitude — hence have 8 times for ½ dia —
If lever reduced to ½ thickness there is flower in a square of depth then reduces to 4 times, if reduced again to ¼ — same as above —
So 1½ dia 10/1000 — then 3/4 dia - 2½/1000 makes same amplitude with same air leverage & power as before —
but weight will be ½ dia 4 times
¼ thickness 4 "
Total 8 times less wt

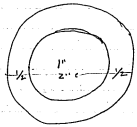


Mch 9 1910

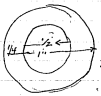
hence dia must be 2" 4 times thinner
& thick - if 2½/1000 - it will weigh 16 times less

Mch 10 1910

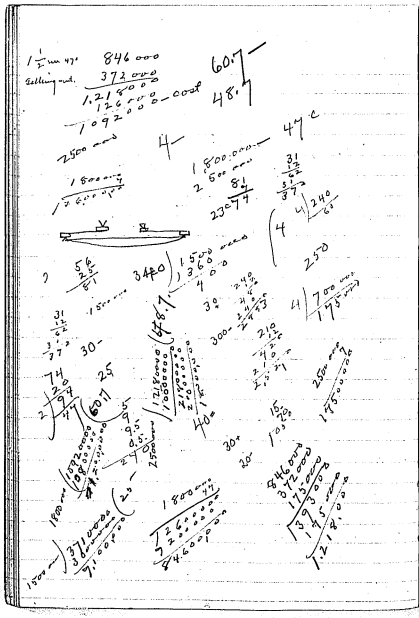




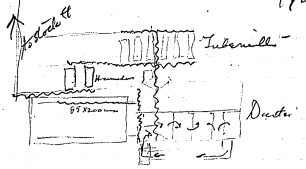
limit flexp 3"
weigh 400 -



limit flexp 1½
2 dia " 3 -
3/4 weight

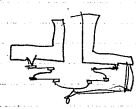


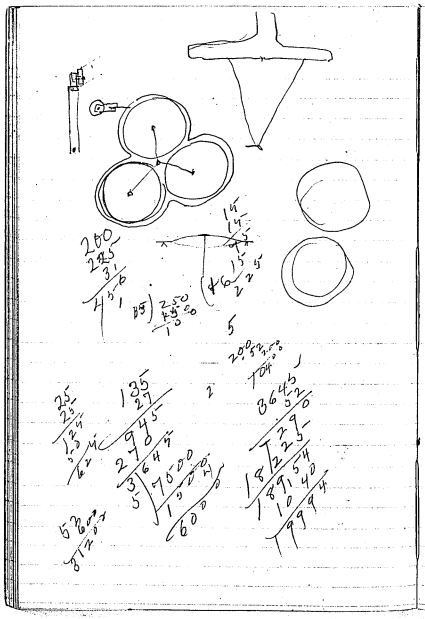
Cement Mach 10 1910



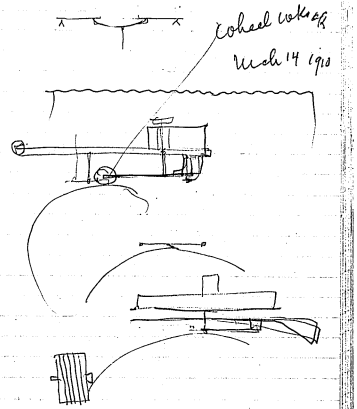
1½ million 56 Cents - Sell 25 total 81.c
bags deducted 74 Cents

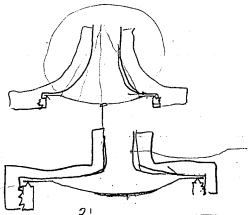
3 million 27c Extra no selling exp - Ten profit
makes 20 0 Cost, Total Cost 47c
Sold,

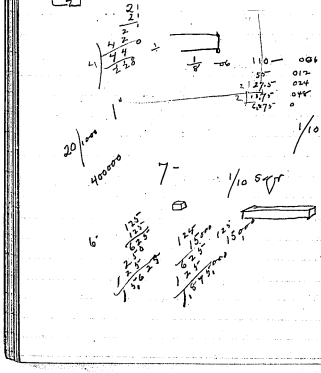




Mahio 1910

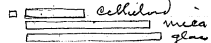


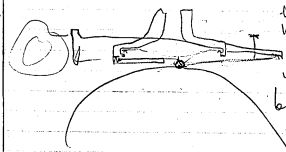




March 11 1910

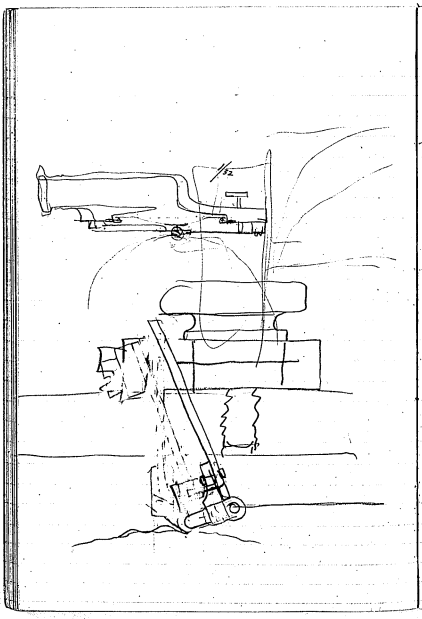
006- Celluloid 21/64 equivalent to 1/10 inch square & 7/8 long
of mica equivalent to 1/10 sqr 1 3/4 long

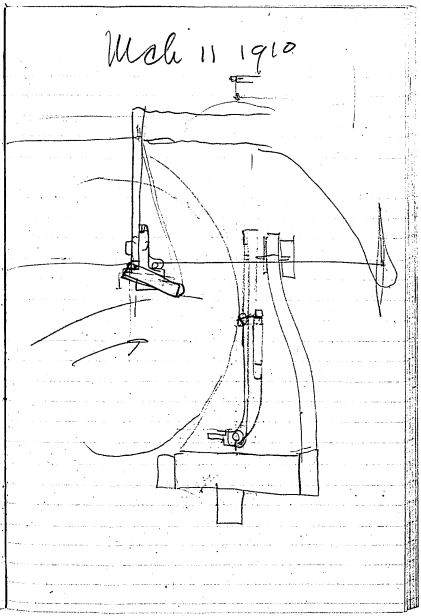


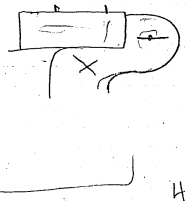


Wheatstone has commutator margin even with stiff spring but think it dangerous to Records.

hands public without some [illegible] on adjustment.


1/32


March 11 1910



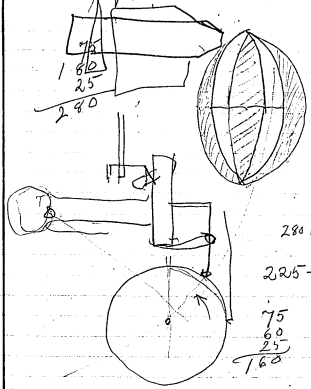
240 | 1.44 | 4.8

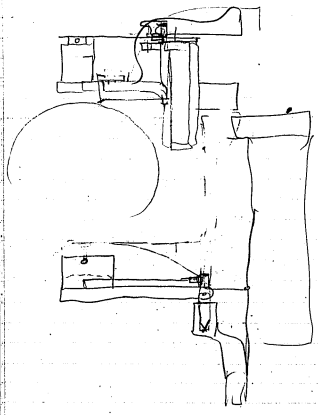
1500
960
19

15
16
90
30
144

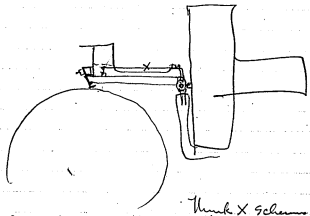
4.8
191
36 lbs

March 13 1910





March 14 1910

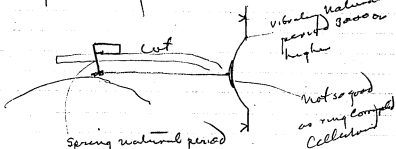


think X Schum belts
then wheel —
X Counterabling operating
3/4 of pressure direct to LOP
Taken off replace point
+ at same time put 4 turns
the LOP for working all
swinging on same center
with lever to diagram —
so track good

I think our diagram wrong
parts heavy always ~~been~~
too heavy + that we have
not had enough light throttling
periods enough

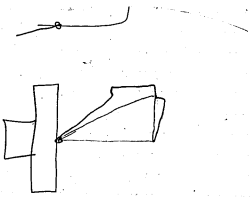
March 14 1910

By Drapin of paper possibly a baked shellac



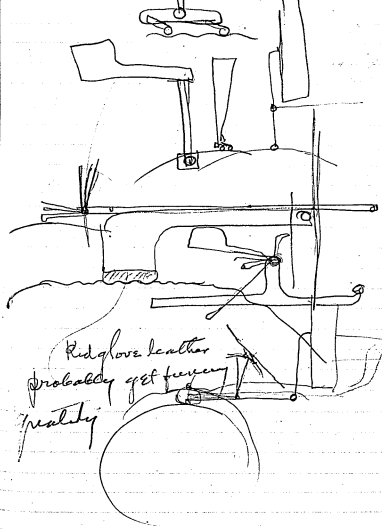
Weight 1 mm wing Dia 80 milg
Spring 60
wire 5
145 "

This should follow track truly -

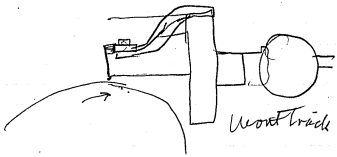


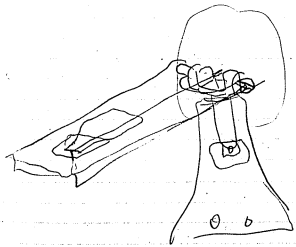
F

March 14 1910



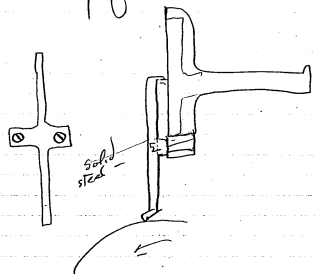
March 14 1910





March 16 1910

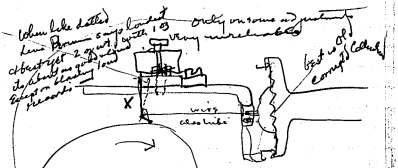
Tried if the lever of Reppler ~~[illegible]~~ wedge ~~[illegible]~~ the wooden foot to transmit heavy like tuning fork



Did not work accurately heard shows that must be a fulcrum or Rock —

Model
Keep —

March 16 1910



Cellulod 006
arched only
1/4 flat for
flexing —
on Knife Edge

Loudest we ever had
with 2 oz + quod.
but it will not give clear notes on "Wrapping" on land part
no matter how much weight.

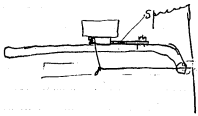
With 1 oz OK on weaker
Records + which it moves
Ours doubles Volumn
Round —

Had X strung at first, got louder
+ louder as we thinned it down
more + more — after 1 oz
adding weight dont increase
loudness but makes quality
better — stops flutter + rattles —

March 16 1910

shellacing the wire from lever to
Dia at loose joints dont seem
to make it any better,
putting in steel tube .0035
bottom, + shellacked

March 17 1910



Mounting fulcrum of wedge lever
on a stiff spring $\frac{1}{32}$ by 3/16 wide
It gives with no weight on end
spring Valve 1/3 of best + little
lower Chart Reg Regular
but it is perfect, showing that
it tracks ok - out of lever 1 oz
hence a spring mounted
fulcrum with 1 oz pressure
makes record perfect

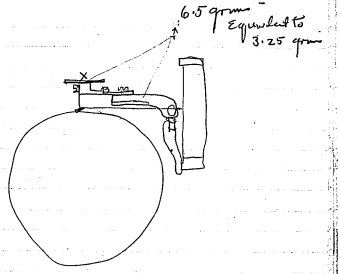
now if 3 gram head Gs fastened
by cord at end of spring lever
the Volume is doubled & is
louder than Reg receiver
by pulling it thus

So weight about 1/3 of 1 oz tracks
perfect + very little dif in
loudness —
This shows that we shall be
able to reduce weight
greatly + get big Volume by
diminishing + concentrating
the weight at fulcrum of
working lever, + then to
prevent rattle lighten the diaphr
+ increase the fulcrum at
same time + make the non
flexing part so no flexing at
all —

3 x 9.

" 9

Theoretically there would be no fluttering on low notes if the weight was fixed & dis-charge, but owing to sluggishness of low notes the weight has time to move whereas high notes it has not, so the weights must be enough to take care of the bass notes the highs will take care of themselves



6.5 grms only chops tops of strong noted Can hear high notes ok + good amount fluttering of strong notes. added on X 16 grms, made it louder than Reg Reeder but still some flutters on heavy waves, — added 9 more didn't stop flutter but quite louder took off the 9 & added on X This was just as loud but flutters less,

3.5
4.5
16
24.0

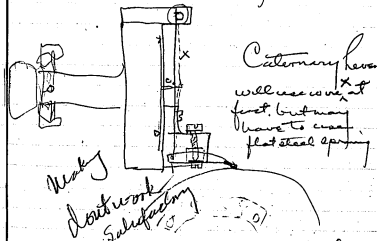
24 grms press made it much louder than Reg but flutters on heavy notes

It looks as if the lever (10) reg
should have a certain pressure
say 6/10 oz + then the wt
added at X can be balanced
nearly + not add pressure to
ball but act purely by
inertia
or perhaps the lever should press
down the ball by spring pressure
+ not by weight + a wt added at
X to give inertia – it dont seem
to want much weight for inertia

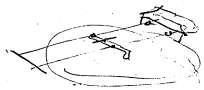
March 24 1910

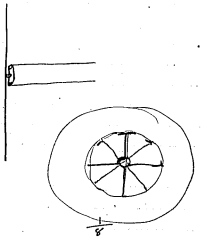
made dia Cellulose

but it flows all over
probably should be deeper or
not have the Corrugations in

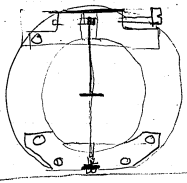


Idea on Surface gages like
Trescodes then use bridge
& but of like Reader use
link —

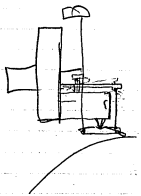




Mch 24 1910

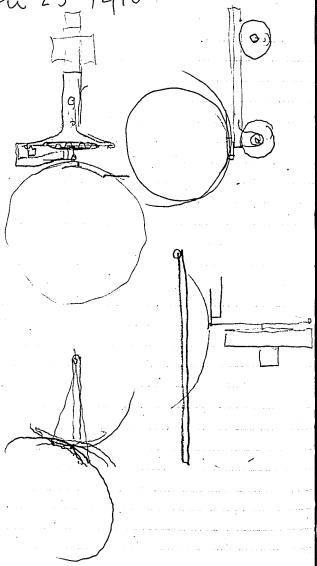


Catenary —

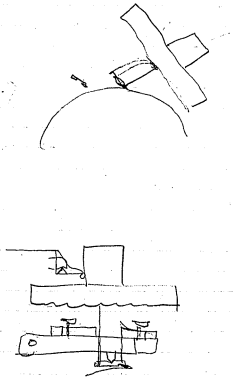


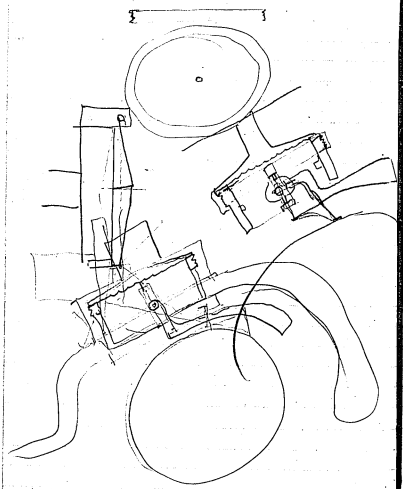
Spotwork
Schrafirung

March 25 1910

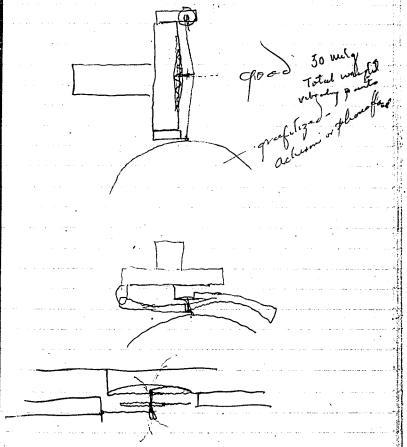


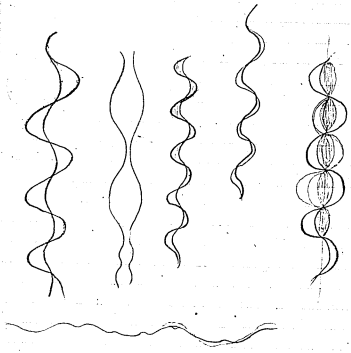
March 24 1910



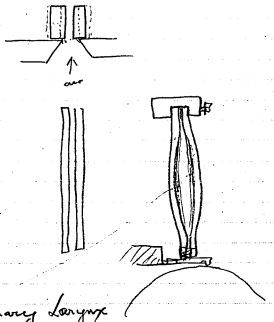


Mch 25. 1910



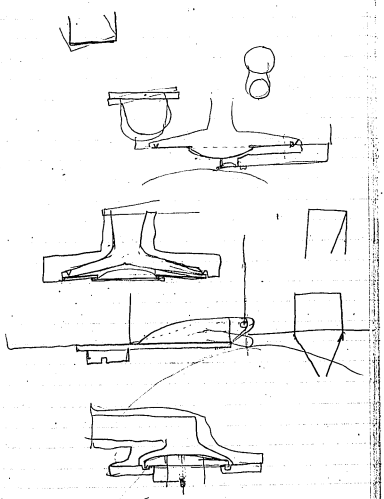


March 25 1918



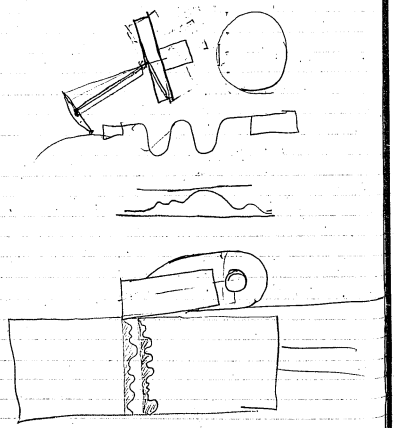
Catenary Larynx
for air phone –

Mch 25 1910

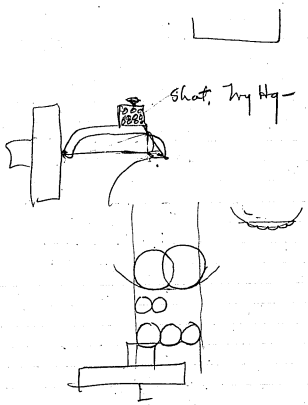


Vaseline
or oil?

Mch 26 1910

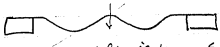


Mch 26 1910



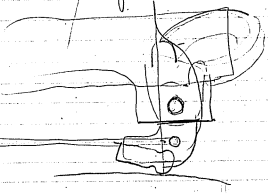
March 26 1910

If you pass 45 deg in elsewhere I think the die will become very flex for nephews

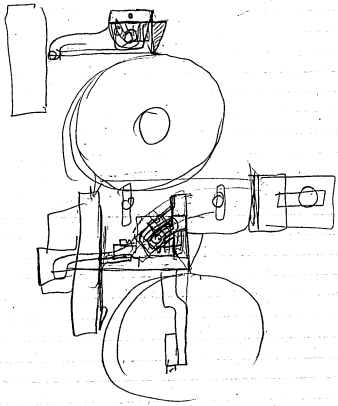


not flexible to any extent

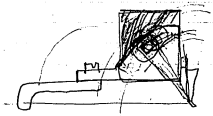
quite flex

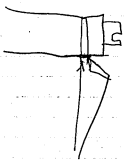


March 27 1910



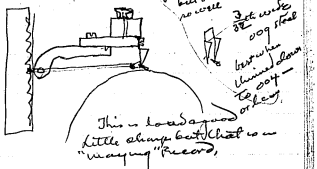
March 29 1910



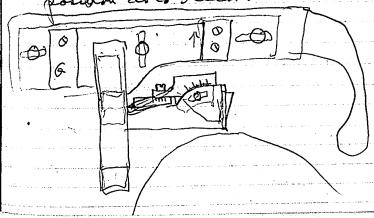


April 1 1910

We are gradually getting to the good reciprocating —



We are now making a reciprocating with indexes to determine angles — length of rotating lever, weight & position onto screw —



64) 1050 (16
64
470
464
6

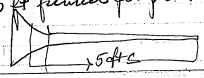
256 (1050 (

2) 256
128
64

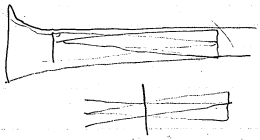
Apl 1 1910

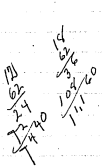
This device can adjust vibrator levers to & from the Dia also at any angle & also put in levers of various lengths — The whole apparatus can be adjusted up & down in relation to Record — to & from the Center of the same

It looks very much as if the recording funnel should be a little longer as long as the wave to be recorded - (10) 256 vib should have funnel 2 feet & so on as piano mostly 100 as lowest used — 5 ft funnel for piano

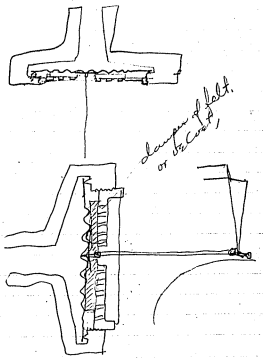


If shorter funnel used
a part of the wave loses
its pressure outside &
there is deadwater





April 2 1910



72 to pay out

65

850

1350

20

1400

59 - average 27000

1350

270

1080

21,6

1400

560

560

560

61,600

65 -

72

60

432

216

63

59

200

5600

64

300

60

1800

1080000

200

1000

850

200

56

292 -

30

1500

450

270 000 bricks

104 000 ready mate

188 000 open

292

750

112

16

56

72

65

45000

4000 -

1500 000

1320 000000

1320 000000

1320 000000

9000000

16

20000 -

1500 000

20000000

1500000

5000000

1

11000

4000

4000

4000

1500

75

300

1050

12,500

9000 - loss

April 4 1910

190,000

73,000

253000

80,000

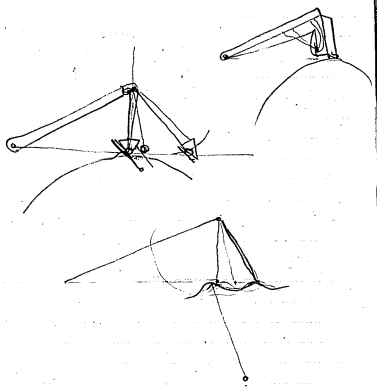
373,000

150000

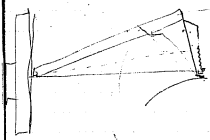
125000

finger pad

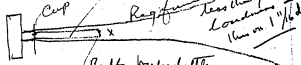
April 4 1910



Apl 4 1910



Doesn't go good,
3/16 combination at
outlet of Cavity is
little thin 1/32 5/16
Reg. fine less than 3/16 diameter
Lowering Throat 1 11/16 dia

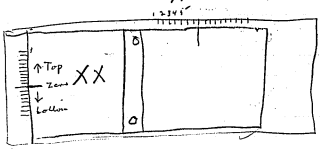


open at X $\frac{1}{4}$ inch same as Cup.
Then tube induces scratch sounds
& mellows the Quality of Cup
but apparently non periodic
large movements of diaphragm
only had it 2" long which by
all variations Then tube is put
on Cup underneath & Well
fastened by a brass ring
Hereafter I shall get an
adjusting screw so public can
alter Volume equally

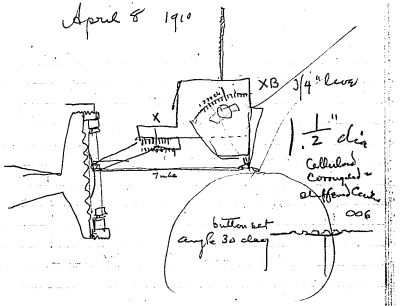
Apl 8 1910

A Tandendying Reproducer
with Indexes

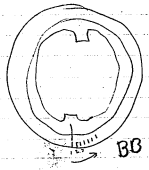
XN



April 8 1910



X Index from left 1 2 3 etc
XB " " 1 2 3 etc



Apl 8 1910

Standard Reader -

Just as it comes from shop it is very loud a Victor Herbert is 4 times louder than on Reg all say its more mellow - Some of reg 2 min bands are harsh & chattering up but these are all both jumped out. New recorder used on piano very mellow, Record best from Orange from Big Piano louder & more brilliant full doubles - Mina unanimously said records were better on 2 oz Wheat 1 1/4 This couldn't detect it a little bass (deep) that chatters & extra weight stops it more or less - these faster sounds are wiped out to Mina when she diminishes the volume by putting finger in Ear but not when volume is reduced by crowding handkerchief in funnel There is no doubt but new recorder is very mellow, perhaps too mellow but this can be stopped by thicker disc or more tension on spring - On Standard R piano here is recorded & reproduced perfect equally as piano sounds which

Apl 8 1910

is a poor one & weak

All above is on

Index X	2 1/2		Weight 1 1/4 oz
" XB	7 1/2		for fixed weight
" XX	1 Top		ok on this with
" XN	10		our piano & new recorder
" BB	Zero		

With above index - I am sure all kinds of records of taken with new Recorder will be fine & 4 times louder than Regular with 1 1/4 oz weight total -

Moving index BB 1 to right this looks dis little but think it will act itself - dont exactly know dis but tube may have latitude enough to take care of considerable movement of BB my 1 to right certainly makes it louder.

Now 2 to right

No better probably 1 is ok + improvement

Apl 8 1910

Tried BB 2 on piccolo — yell.
then No 1. No 1 Best — We adopt
this as standard —

Rose Mexico

XN — we now make 11 deg
No louder — imagine better,
imagine better yet loudness apparently
same 13 degrees. same loud
quality of 12 13 & 14 some around not
much scratch, bones sharp & clear
14 — imagine little less loud
& perhaps quality not so good
on loud finish — 15 — about the
same — I now take a jump of 3
to 18 — it less loud but its
sharper. So this is a way to get
sharpness — Back to 16, this
is 50% louder than 18, more
mellow but not clean so far
about 13 @ 13 the best for quality
& cleanness without any
appreciable loss of volume
~~Now we~~ put it at 13

Apl 9 1910

No 10 on this index is the
Center of recorder We now
go the other way 10 to 18
to part the Center, Now we
go this side to 8
found it about as loud but
Rattles, our big notes NG

With the original adjustments
13 to 15 is the best on XN.

We now go on Index X which is
2½ now it on all previous tests
we set at 1. No good whizz
& not so loud don't follow track
Now set at 3, imagine the noise
so loud as 2½ its sharper —
~~Just~~ now set 4. Little less loud
but very sharp, more like phone
tone This is a fine way to
get sharpness, 2½ is
best for Mellow Controlls —

2½ best — put it back to that

Apl 8 1910

We now work Index XB it sounds
7½ — we now go to 6 —
not quite so loud & too sharp
we now go to 4 = about same
little sharp now to 2 =
not good — mushy —
We now go the other way
from original 7½ to 9 —
Loud ok sharp no mush on
base — now 12 = now 11 scant
loud — sharp its good but
would like to have it more
mellow — Cant give it more
as clamp strikes, if its sharp
but probably record is sharp
& that new Recorder which is
too mellow will be just
right

All previous Experiments
on 3/4 inch Vibrating lever

Inch lever
Apl 8 1910

We now have
BB 1 on index
X 2½
XX 4, Top same as
previous XN 13
XB 11
We now put in 1 inch
lever —

a preliminary trial when XB at 4
is loud but not good on Mexicos
Burn on Herbert —
Now set at 11 (to) XB Loud
very = has a ring = we now make
X 3½ weaker — 2½ to lighten
link as longer
& spring is weaker by leverage
3½ very loud thunk & louder
than 3/4 inch lever
Oth Sings big bass at end don't rattle
Its good on Herbert Flutters, but
makes some defects we go to
XB 14 — & Cant do it —
We quit on it with XB at 11 & X at 3½
as only change — Its loud & good at this

Apl 8 1910

but want it more musical on heavy
Clash bass and more at 4 more
perfection on Herbert of Cathedral —
~~the 1/2 lever could be~~
~~better~~ —
As far as I can judge the
3/4 lever is better & preferable
tonally as sound
therefore so far 3/4 lever is it,

Now for 1/2 mel lever

X set at .1. instead of 2 1/2 as
lever is now stiffer this to start
with, Ott says no illusion on disc
must come to 3. Waltke has probably
made the hook longer & this throws
out X index —
Its very sharp + not as loud as
3/4" about 75% of the loudness
but still very loud - best tumbling
sharp not dry mellow - but it
evidently brings out every note clear
+ absolutely no rattle on big bass
at end mezzo with a mellow Melaxolo
this should work fine — No doubt
if the spring at clamp was thinner

Apl 8 1910

or better 5/1000 stock spring steel
instead of 9/1000 it
would have sound difference as
9/1000 on 1 mel lever + 62 very
musical lighter. There is no
use pulling off more tension at
X as its too sharp now —
It brings out Herbert of Cathedral
perfect. Schumann fine would like it
little more mellow. its fairly loud
but no so loud as 3/4 &
with our new recorder piano record
Record is just as Mellow as ever
but not so good, piano no loud
is nearly perfect + on a new
record would be perfect,
but record is badly worn
altogether the 1/2 is not louder
Enough + while it reproduces
perfectly its too sharp —
Fred Ott is thinning it
down from 009 to 005 —
It makes it less sharp but there is
a whiz so fast sharp - its not quite
so bad I imagine —

Apl 5 1910

We put XN which is now at 13
put it at 12 to see if improves
it = Its more mellow & considerably
louder - Otl says it will vibrate on
loud notes, I now put it at
XN 11 - Louder best Otl says vibrates
on both loud & soft notes,
X is 3, but can't tell anything
about X on account Wood the making
hook longer - Horn Flat then must
be a working point on mouthpiece -
on all covers & therefore index
will be 11 — We put it at
4 = - Louder & probably as loud
as 3/4" Lower, but its opt whether
in 4 not good -

We not put back the 3/4 lower

XN 13.
XB 11
X 2½
Others same -

Apl 5 1910

It duplicates Exactly the first trial
Herbert's flatten funk -

I cant say if the 2 min seconds
I have here are dropped or spun.
They show wear the first time
over not wear but the clock
seems to be drawn forward in
the direction of retarding where it
goes up a steep hill - Yet the
weight is only 1 1/4 oz -
This shows that the weight is
not an index of the pressure
without these seconds are
dropped as I have run Herbert's
flatten more times than the
two 2 min & it shows no wear &
Entirely dif kind of surface
I think the Mouteau & Spun
& the others are dropped & soft.
Have run a Sousa band now 20
times, on loudest part which is
very big undulation cannot detect
but that it is as good as ever
but under Mueno its horrible
up hill drawn over the tape
all an industrial look it is unmovable

Apl 8 1910

How it reproduces yet it sounds as well as ever. It is slipped second & very soft —
We are running it still more
It is now getting a little jumbled
after 26 times, so 8th trip
after 33 I can scarcely notice anything = 40 trim. Took it off
doubt if public would notice much change but would say 40 was bent with 3/4 oz per 1¼ oz — for dropped wax

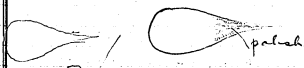
I think cog should put button in at angle 16 to 20 instead of 30 on 3/4 with another move XN from 13 to 12. This will increase loudness — Eggleston thumbs it bent =

Dieman turned off on 4 min. bent & recorded piano —
Could not track deep enough jumped out some but finally good little sharper than cobble

Apl 9 1910

wax & corrects somewhat the excessive mellowness of ring
Knife Edge recorder
Hz also gave his yell tone
This jumped out

Yet the 3/4 tests ~~[illegible]~~ standard
Replica reproduced it clearly
with 1¼ oz (12) no extra weight
run over yell 10 times.
It tracked absolutely central

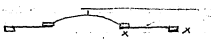


Can see no track on Extension
Evidently Mentor is going to be OK even on 4 minute record for wax with normal 1¼ oz. which will reproduce anything adding wt doesn't improve it appreciably — going slightly over the Center XN apparently was the great feature of improving & coming back to track —

8.

Apl 8 1910

Inertia in this armbend prevents record that while the yell was reproduced OK yet with more less prominent out there was doubles in the piano when chord struck These doubles are strange I now find that the Recorder used what the Natural is



X x rubber rings cemented this would account for the doubles --

Reproducers - 1 knife edge -
1 1/2 Ring dia double
Knife edge - on Study Reproducer 1/2 Ring
Sharp clear as a bell sound
& I hear no scratch at all
Pierman says there is very little
Dia 7 1/2/1000 - Al arch .005 -
" 47/64 - at knife edge

Apl 8 1910

Myers Piano - 1 1/2 Ring Recorder
Pierman says good quantity, very little scratch, I hear none, Pierman says Mellow, I think not very mellow
Valum good — yell OK
+ talking perfect, sharp clear, fine -

1 1/2 dia Ring Dia — 1/32 deep

Big in it some double quality to me better Valum better 25/10
7 1/2 Thick - Al arch 35/64 at Edge
This is the best of Can preserve quality + Valum + get no release on chords

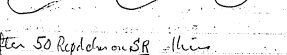
1 inch Dia - Valum 1/2 of 1 1/2
Sharp — Yell perfect of course
& thinner Dia cone 62 need
instead of 7 1/2/1000 + more
Valum Ele,

These results prove that the Ring Knife edge Recorder is a great improvement in the art

Apl 8 1913

Have increased spring pressure on
$1\frac{1}{2}$ Reeds to see if can get
Chord bug out.
It is now free from wing on Chords
at least you can only imagine a slight
amount in one strong chord. The
Volume is scarcely reduced 10%
+ Quality Mellow OK but not quite
so mellow as with lighter pressure
Pressure will put on a screw +
index to measure pressure,

Pressure Turned off a Moulan 4 min
+ Recorded Piano + yell –
the yell jumped forward



After 50 Repetitions on SR this

← way cylinder went

Apl 8 1913

X is narrow + looks exactly as shown it is
not deep + bottom is low its undoubtedly
due to ball going up N which it leans
in twice, winding up lever + disengaging when
it comes to top the momentum of the whole
carries it in the air + when it comes
down it makes X.

after few runs it about like No 1 the
longer you run the longer X gets
this is due to wear of N. The
clear air space or space between
record holes gets less + less. +
at first the ball lands in the next
hole ~~to~~ perhaps this theory isn't OK
that it starts at Edge of Hole at X
+ gradually wears a groove X which
is more likely =
The disruption of the wax at N
makes non periodic waves + results
in record ~~of~~ yell getting more noisy
a number of Repetitions increase

Apl 8 1910

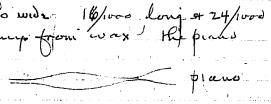
I feel sure this theory of starting of wear at round edge of hole in a jump out is correct and it will lengthen even if not jumped out but comes very near it on apex of a half the same place affords a starter to wear as it will certainly increase —
The flowing + tearing qualities of the wax should be such that the friction between balls wax should be insufficient to tear it or cause flow of material

Pin main 1½ if spring pressure increased it gives Volume ~~of~~ of 1 5/16 - but not so good. probably if more and pressure was used it would give more Volume & a longer life of 1 inch Reels + not be as good on account of momentum points = It looks like 1 5/16 or 1" for good results with thinner disc + less weight points to get quality + Volume but as far as can see 1½ 1 5/16 or 1

Apl 8 1910

with 7½/1000 - 1½ is best w/ a spring pressure is just sufficient to stop chord lobing —

In the Micro. on the piano Record on Montani run over 50 times not the slightest evidence of wear can be seen on piano wave although on the verge of jumping — they are long - 10 inches the yell has a high powerful note + about 13/1000 wide 16/1000 long + 24/1000 clear jump from wax. the piano



What starts the wear I think at edge of hole is that ball coming up previous hole drags wax out + after momentum ceases ball goes back to record with load of wax. This starts cutting back on the trail + longer the groove the coming up of previous hole is worn

Apl 8 1910

from this the conclusion is reached that a screw which strikes wooden so material is loosened or comes up vibrations the debris will start Cutting the balance of the screw

~~We are now making a~~ ~~Reed~~ which works better than the old and very Reeds + it will certainly not jump out —

Idea —

The weight jump right out here 1 or 2/1000 dia. bunched at angle 45° or thereabouts

Apl 8 1910

1½ Reed adjusting screw previous lightest can attend — Zero —
~~Also~~ Mellow loud but full ohing on loudest Chords —

1/4 turn more

Mellow. 20% less loud very fine on quiet but ohing on strong Cords ohing very high ~~pitch~~ pitch, Sand —

1/2 turn

Louder than 1/4 — Mellow, but has ohing a flutter on heavy Chords

3/4 turn —

Volume comes down so its not mellow + ohing not out a not as good as 1 5/16 —

So far 1 5/16 best + is greatly fine + loud enough + worst Ex. loud on Steinway grand at Lab next best is 1 inch

Apl 8 1910

I will put in a Thomas disc in 1 inch, 4½/1000 Mica - pretty good. Piermont thinks no one would want it louder in a house. It reproduces the Yell perfect & the piano is perfect but to me its not mellow enough & would like it louder tho however nearly as loud as Herbert's flatterer if not as loud -

My idea is that with a large disc say 2" you have a big range of amplitude, whereas with a small disc the range is small but in both cases at neutral point both are equally sensitive, the sensibility rapidly diminishes because the 1" disc reaches its limit four times quickly than a 2" hence ~~the 1"~~ will record a greater range of variations in volume without jumping out than a 2"

Theoretically the 1" should give a greater amplitude than

Apl 8 1910

2" as a given sound waves loses in leverage in a 2" & has more power & with 1" less power & more amplitude but is that multiplies this is that the elastic limit of the 1" is reached on small amplitudes whereas the 2" reaches a great amplitude before it reaches the limit but unfortunately in the meantime it permits the knife to jump the record -

What is needed is a 1" disc with a greater working amplitude then we would have maximum distortion by momentum & quickness

1" now with .006 Celluloid & Aluminum Center, Bury Celluloid pressure is as too light but it was loud & shows energy

Now increase pressure of knife spring sufficient to hold it on knife edges as it skipped before having scarcely any pressure think that Celluloid very

Apl 8 1910

Center is going to be the best + on 1" dia — + I also believe that the knife lever can be made lighter, with a longer elasticity as 1" dia have little power but great amplitude of the den pennis,

to have got pressure on Celluloid sufficient the knife was a wrong angle as had bow dia way down This shows great latitude of Celluloid + I know its best for Reporter + I believe it will be found best for Recorders or, an analogous material

I notice the dia slips around over knife edges I want a recess to hold it from slipping on edges P says it will make a buz I don't think so apparently he don't make it without orders. I think both the Center + outer Edge could have knife edges + recesses to stop slipping without any noise recorded

April 8 1910

P has now set his knife on 1" Celluloid - Ring Recorder He got too much pressure its lower in Nalum sharper but perfect I cannot see a single vibration by the Eye the record seems to be only tracked = 3 times over the yell cuts the up hill part, they are 13/1000 wide - not jumped the yell was skipped once perfect the 1st time over —

Tomorrow the 9th P will put on a knife & spring having more Elasticity & greater ranges of adjustment to be had,

I now have run over the piano record taken on 1 3/4 Ring dia described few pages back, for 15 times + there is still no signs of a clatter or chig on heavy Chords showing that when the dia is more sensitive or larger that these clatters + chigs on heavy Chords are actually

Apl 8 1910

recorded & are not due to the reproducer of a good one like SR now used —

Now the Clatter must be due to a superimposed wave due to momentum of the points, or 2nd to a buckle in the diaphram points, or the catching of the knife & causing wave to go deeper than usual so due to the sound wave.

We only get it on Pianos & it occurs when the record is no whiners near jumping out in fact has a weak appearance to the eye it occurs on heavy chords which jars everything in vicinity is felt on windows etc.

The moment we adjust for sweet Mellow & Volume this phenomenon occurs — They are possibly due to beats one between being out of time with the other. If this is so we should be able to stop them by turning the piano exactly. Then again they may be due to keys being struck too near simultaneously

Apl 8 1910

Notice that the scratch is gradually increasing & is very noticeable after 15 times the record shows bottom of groove is tearing & the up hills are showing plastic removal of stock. Don't notice any very apparent weakening of the Volume.

30 times over can't notice any clatter or whizz on strong chords Volume about same can't notice any difference. The scratch which is continuous is very much increased & quite noticeable when music is playing — ~~Apl~~

40 times over same Volume no clatter or whizz on chords. Continuous Crackles — bad — Quality seeming good — possibly crackles due to fuzz removed & plastered over the record.

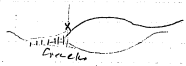
April 9 1910

Pierman on the Recorders cases a solid spring wire to be flattened.

This is too heavy & weighs more than the whole dolphin - especially the inch disc — going to make one like used on SRpder —

Using the Moulan Piano records Extra 54 grams on SR & running 40 times its easy to explain the tit.

Its due to friction drag cracking the Moulan



Soon the cracked X chips out, & then the Chipping Pro grooves —
The Clatter & Click gets less as Record wears showing that the Clatter & Click are not loudly recorded as is also proof by stuffing fingers in Ears when a smack diminution of volume wipes them out —

Apl 9 1910

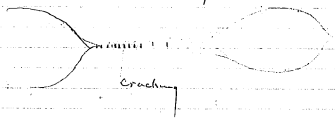
The pressure between a jump out hole must be very great as its only ½ to .003 wide & gets less wide as it leaves the up hill

Haloid Sing.

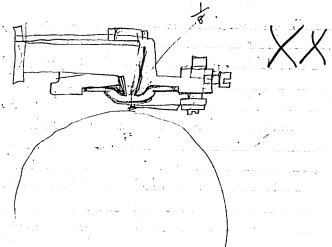
Shows diminution of pressure of Ball on wax as it goes to next hole

Jump out.

This shows it plainer



There is no evidence that the Ball on SR when coming up hill jumps from the Record as we supposed, it probably does on Reg Rpder



Pierman had put a knife spring arm like on 5R - This made it loud (1" Dia) as $\phi \frac{1}{2}$ 1 5/16 + good mellow but has clatter + coing ~~only~~
The chamber is wrong need 1/4" hole or large space of arch part
I is now changing it somethin like XX cuts to make hole 1/8 + smaller chamber
I feel Convinced from this

Experiment that 1" dia is good + powerfy in the right direction & celluloid is good for its great range + lightness - I think the knife arm 3/4 can be made shorter + much lighter, making it quicker + reduces momentum. as to stop the clatter + coing the pressure must be increased its better to do it not by pressing on the long heavy arm but use a shorter arm.

The clatter + coing* on a chord of a piano must be due to lack of quickness in spring knife + dia + too much weight for the reason if we tighten spring to sharpen dia the coing + clatter on a ring dia ceases - but it sharpens it + diminishes its sensitiveness to overtones which appears to be necessary for mellowness + rich quality - The thing

*something to do with knocks

Apl 9. 1910

Wanted to have quickness & yet sensitiveness.

One thing that will help is to lighten the parts.

2nd Have Knife at Great cutting angle

3rd A rather small Chamber -

4th perfectly flat clear & level Knife Edges, -

5 A non flexing Center to the ring Dia

6 Proper position of Knife on record

1" with 1/8 hole same as sketch last page - its Loud as any for family Mellow, & by increasing pressure a little only slight Chatter, only on 1st hearing Chord - It has one peculiarity its uneven in Volume on Certain notes, these are high note cords and the same to these its abnormal loud showing something in Cone Reduced it before we made Chamber smaller, & reduced hole to 1/8 like sketch on back page

PHENOMENON

The talking is the clearest & best I have ever heard on the Phonograph Bar none.

no scratch, & Even Piccolo talked ordinary Voice - The pressure on disc forces it in Considerably

This is the Recorder par Excellence to Work with. -

If the Aluminum Center is replaced with a Celluloid & reinforced with a 2nd piece

Concerned as vibration in Wires on Pianos or Talking yet both loud

it will be OK. if in addition the lever is shortened + possibly lightened it will be better still. a Diamond Knife will be a gain - Cut 10/000 over the Center another gain.

By shortening the lever & lightening it & the Center of dia it will raise the pitch note due to the Kohale + will not probably respond to any note ~~on~~ on piano should it do so to very high pitch, we could use 004 Celluloid + even a shorter spring then it would be better

Possibly it wants a viscous Knife spring such as Celluloid spring or rubber instead of steel.

also Variations in inside dia of hole in diaphm + dia of nonflexing Center

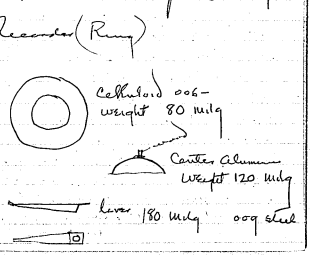
Note

It is always the same after all Kinds of Experiments on Recorders & Reproducers with large Dia + all Kinds of Changed Conditions the ultimate is found that under any Changed Condition the smaller or Reg 1 5/16 is best, with the general impression universal that larger Dia are best + louder Very little has been done below 1 5/16 — because glass or Mica used It is now clear that such Materials are not the ones to use low Elasticity like celluloid is wanted + very minute dia

I even think 1" celluloid on SR would behave better + fully as loud if Chamber made right like latest Recorder even the tube on SR possibly could be celluloid —

April 10. 1940

1" Recorder (Ring)



Apl 10 1910

1" same a celluloid of thick Reg Drawing paper only weighs 75 mlg to very much stiffer than the 80 of celluloid Have OK'd measure it,

Possibly the friction on knife edges would be too great, however this friction is a dampener + transfull suspension so to speak + a positive advantage

no doubt paper of 50 mlg would if right stiff be as stiff as 80 mlg celluloid

It looks to me now that Clatter on piano was peculiar to piano as the sudden starting of immense chords of great power throws the dia into complicated big amplitude waves which it cannot respond to if adjusted sensitive. the waves are half recorded + hence the clatter + echo —

If we increase the pressure to sharpen the dia its becomes quick enough to record the waves but in doing this we diminish sensitiveness + reduce the quality —

The only way I can see just now to diminish the clatter or rather get rid of it + still not have to sharpen the waves is to diminish the weight of the moving parts so they become quicker without spring pressure + perhaps change the chamber possibly making it smaller + the hole smaller —

The Diaphm could be made of celluloid or wax paper 1/2 the thickness. + then built up to same stiffness by corrugating —

The lever could be lightened by making it very short + of Mg or celluloid or rubber + silkoid paper

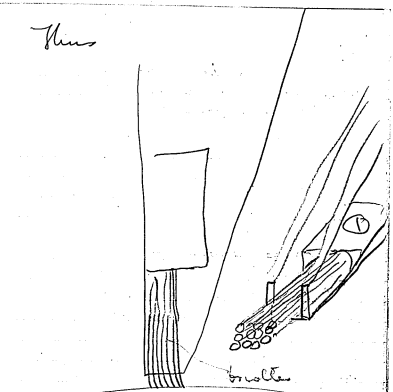
The weight of 1" previously tried

is probably 260 mlg
Think it can be reduced to
110 @ 120 & be even quicker —

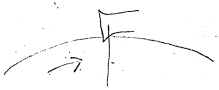
The weight of Celluloid
Dra 1 5/16 in Reproducer is
195 mlg without Center stiffener
Probably cut of the 1½ now
in SR is - 240 mlg
I think SR should have 1 5/16 instead
of 1½ & it would be better &
not wear record so much, possibly
1"

Indian Hog bristle in a fole cleaning
brush vary from 5 to 10/1000 dia
perfectly round & very stiff
~~[illegible]~~ with 6 or 8 & 1/8 Edenmon oil
from Halder think they will
support 1⅛ oz in SR they
certainly would track the
record perfect a wear ark
on Moulan cut legat they cover
the grooves

Thus

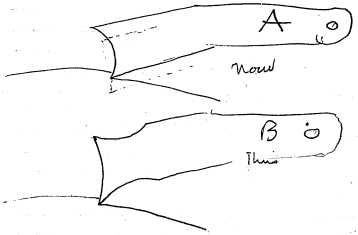


It is almost certain that the knife edge should be set just over the Center, not on or this side of the Center



When there is no tendency for large waves to draw knife in further than it should go - in other words set as is universal in Machines just above the Center the tendency that is to throw out the tool + not to dig in -
We can only do this by having a moveable adjustment + I say we have guessed at it heretofore, whereas the art, the utmost importance, its have it accurate

I also believe our knife should be backed off



Suppose both were standing still, now put weight on both which would either the wax the deepest of course when wax deadens the def yet A hasn't the sharp Edge of B + must requirements power — The cupping should be so that when knife

at proper angle the
Cutting Edge is belvaigll +
not bached off to permit it
to gouge in

Notice on 1" piano cohce tenoin was
increased to stop Chatter + only the base
was very much changed, + not at all Mellow
but cohce it was more sensitive + had
Chatter etc on big Chords base was
Oll + Mellow - Sharpening is noticed
more Easily on base tonge than on high
pitch

25
300
7500

44 cells. 880 — 60 cells 480
165
165
165
165
165
1765 — 240
1155
165
164
165
165
165
Rnd 12 yrs 2145 — 720

196 amp Pb $10 cell net,
50% of renewals

Supposed cost, 750 cells - renewals 25% per yr

750
24
3000
3000

167 | 446 (2.4
9 cents amp list

26 | 175 (6.7

150 | 1350 (9.

204

240
204

2.

135 | 288 (2.13

135 | 2430 (17.2

$$12\overline{)2090} = 340 \text{ and } 6$$

$$\overline{)166} \times 12 = 332$$

$$166 \times 3 = 498$$

$$166 \times 5 = 830$$

$$\begin{array}{r} 56 \\ 21 \\ \hline 77 \end{array}$$ - Cost - with bags 70 c

2 million = 166000 Worth -

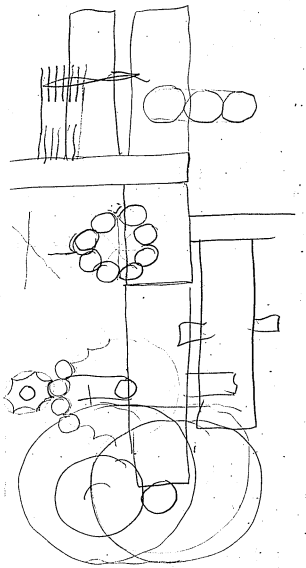
Cost 70 - average selling

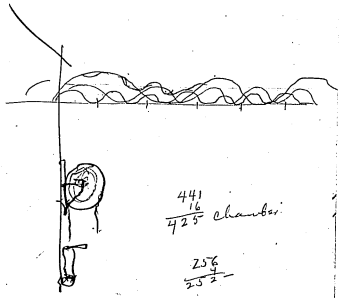
		Profit
	70	00
	73 -	4980
	75	8300
	80 -	16600
	85	27 and 00

$$\begin{array}{r} 27 \\ 12 \\ \hline 54 \\ 27 \\ \hline 324 \end{array}$$

Saving Rule
Flake 25 –
Ai 20 –
Fe 25
5

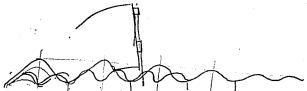
75





441
16
425 chamber

256
7
252



1350
20
2700

1320
200
1080
20

1080
19
1061
900
1.69

10 900